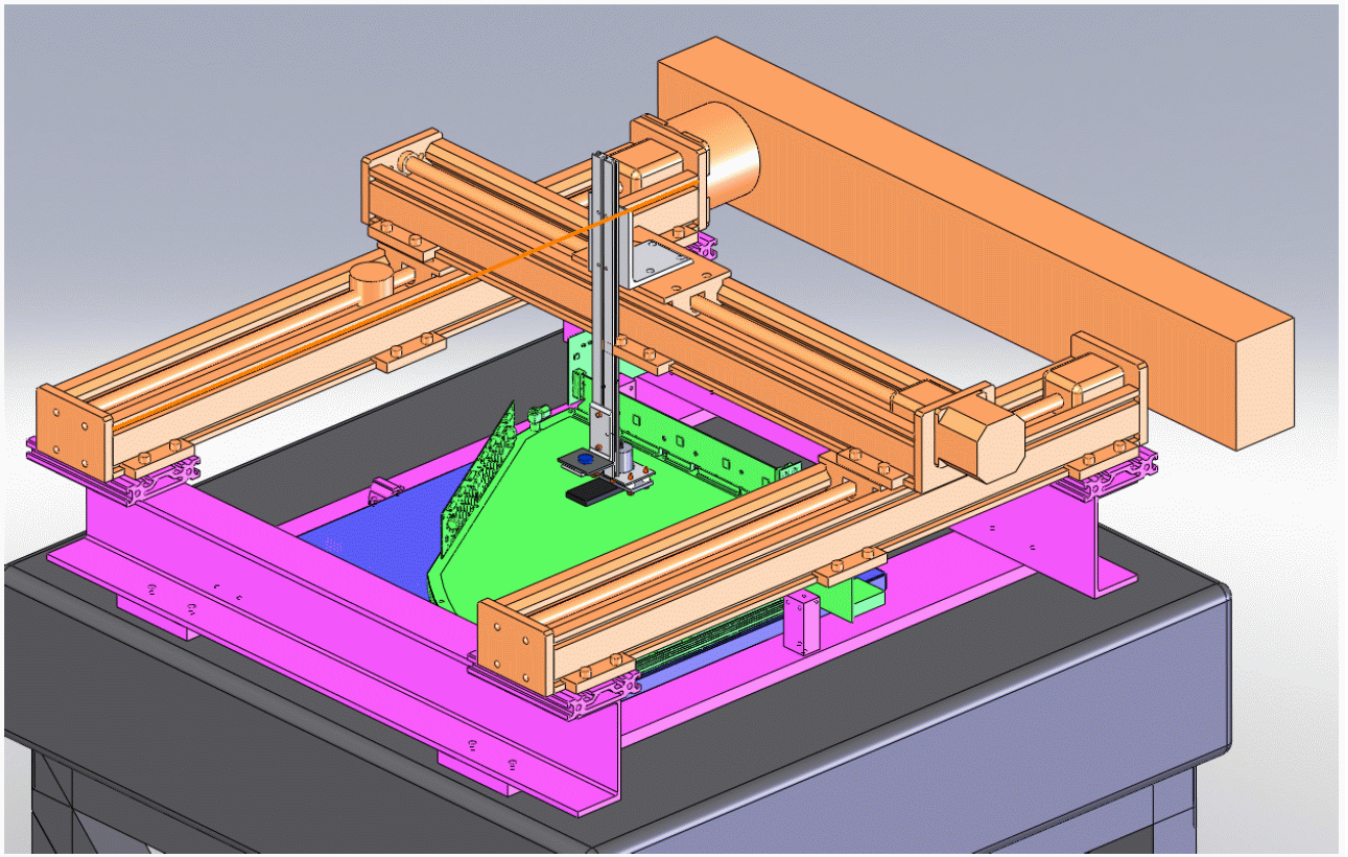
# FGT Quadrant Source Test Setup

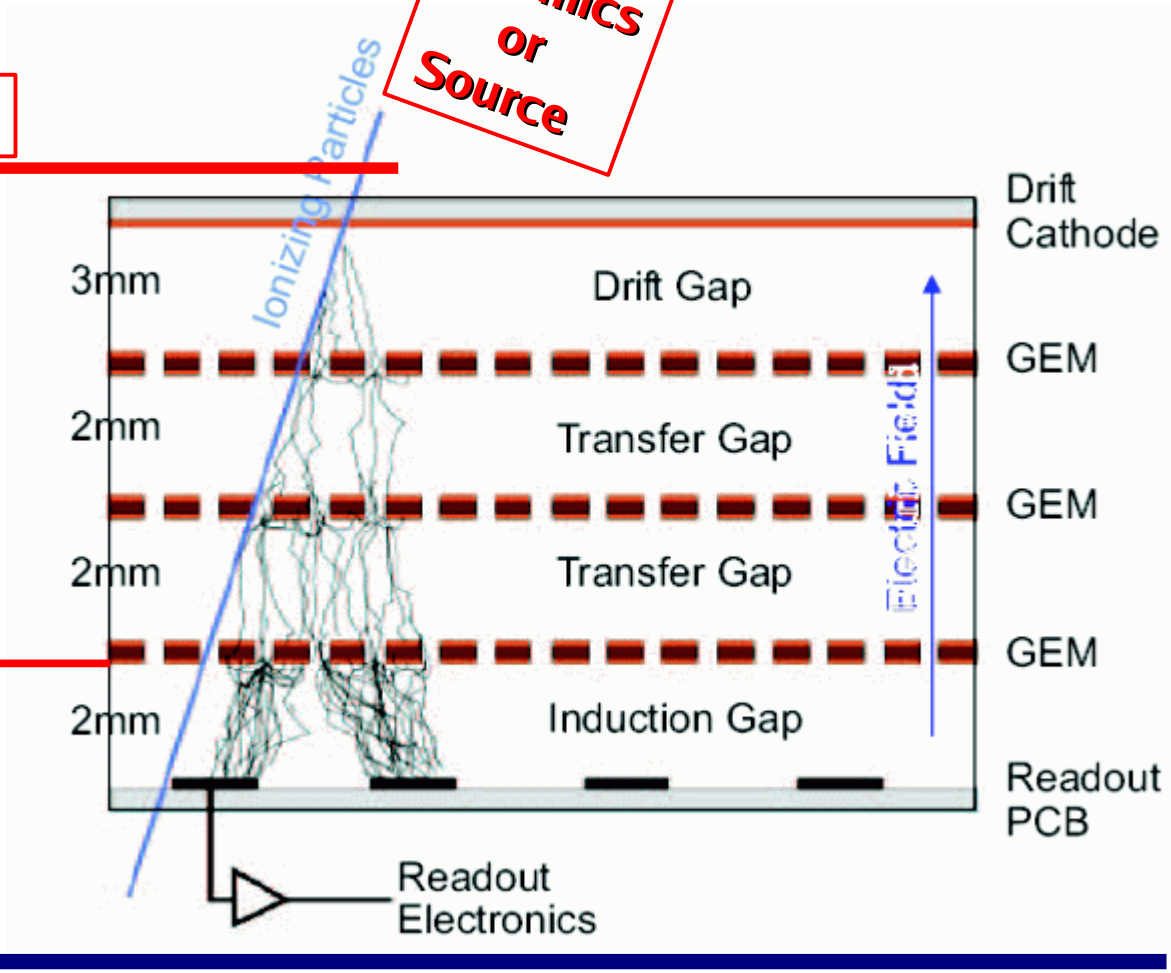


Gerrit van Nieuwenhuizen
FGT meeting
BNL, March 17, 2011

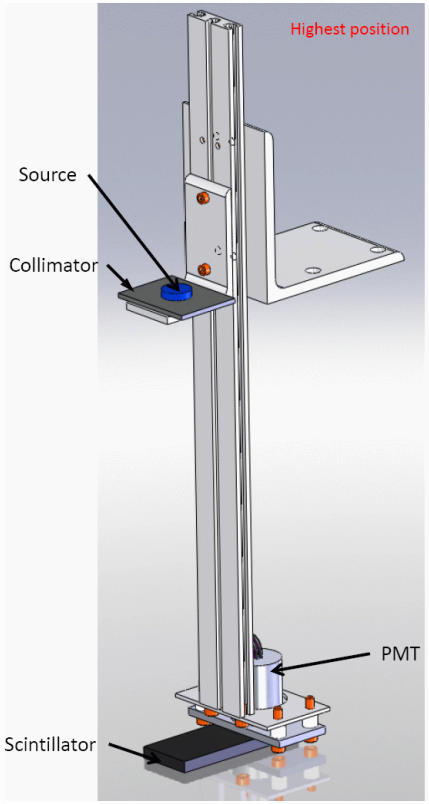
# Options

Scintillator above

Cosmics or Source




Trigger from back of last GEM foil

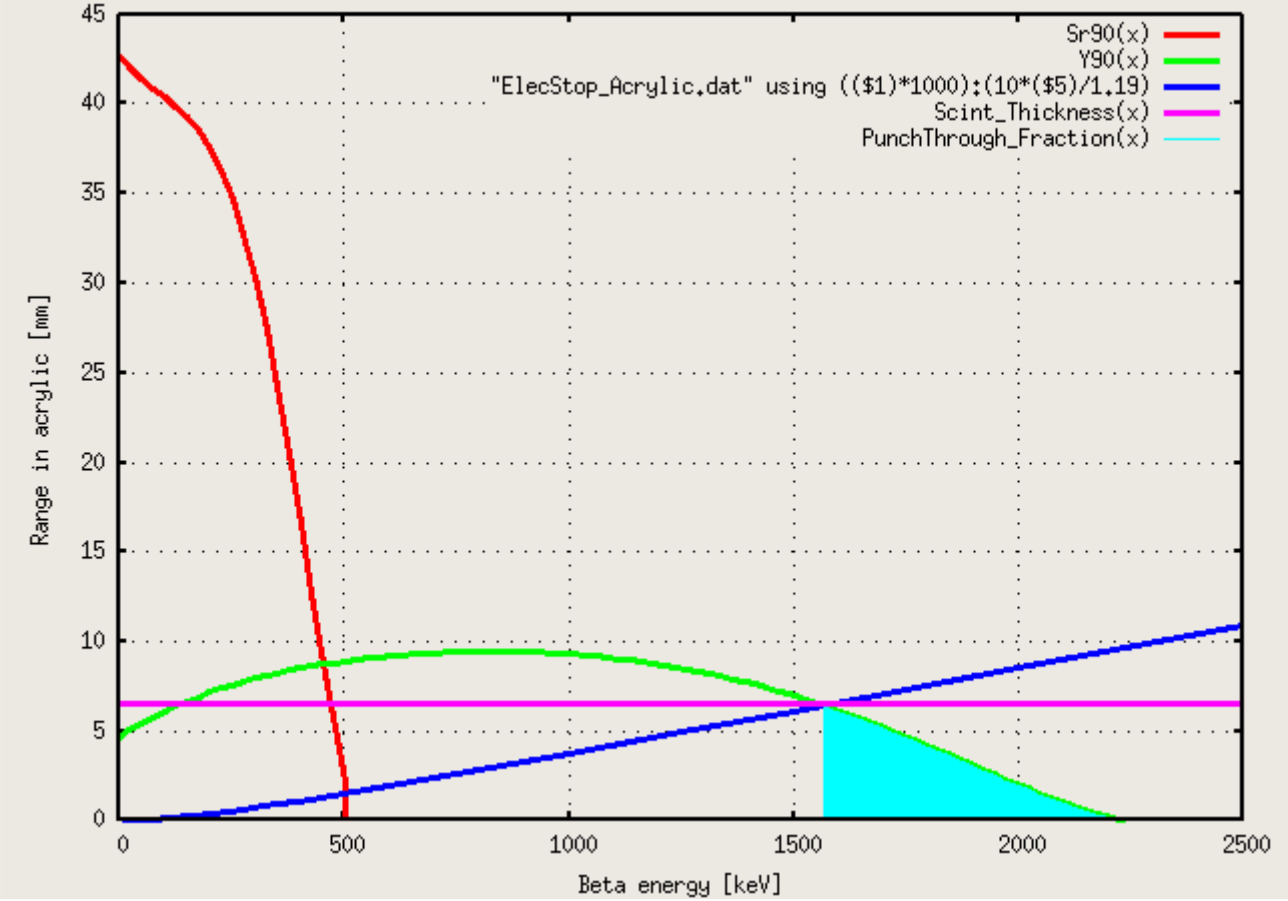



Massive Quadrant support plate

Scintillator below

# Source

| | | | | |
|---|---|---|---|---|
| $^{90}_{38}\mathrm{Sr}$ | 28.5 y | $\beta^-$ | 0.546 | 100% |
| $\rightarrow\ ^{90}_{39}\mathrm{Y}$ | | $\beta^-$ | 2.283 | 100% |




**Only the highest energy electrons make it through the scintillator, does not include wrapping and source window**



**Results with 2 scintillators were not encouraging**

# Source activity and PMT

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Geometrical acceptance for point source:

Egeo = 0.5 * ( 1 - d/sqrt(d^2+a^2) )

with d: distance from source to circular detecting area
        a: radius of circular detecting area

-------------------------------------------------------------------------------
Specify type of beta source incl. activity to test triple-GEM chambers
in a grid of 2cm X 2cm, about 100 locations completing one chamber
per day acquiring sufficient statistics for gain uniformity tests and energy
distribution.
-------------------------------------------------------------------------------

Say 1000 counts in peak over 2x2 cm
reasonable perpendicular impact, put source 20cm
away, grid of 2x2 cm^2 approximated by circle
of 1cm radius
--> Egeo = ~0.0006
for 1.41cm radius
--> Egeo = ~0.0012
for area equivalent = 1.13cm
--> Egeo = ~ 0.0008

Say 6 hour test, 100 locations = 216 seconds per measurement
So need 1000 counts in 216 seconds
= 4.63 counts per second in a 2x2 cm^2 area
with a geometrical acceptance of 0.0008
= 5788 desintegrations per second
= 5788 Bq
= 0.16 uCurie
^^^^^^^^^^
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**Note that this is practically the same as for cosmics**

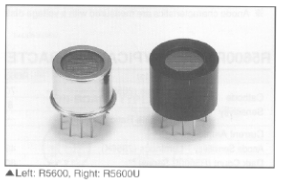
HAMAMATSU

METAL PACKAGE
PHOTOMULTIPLIER TUBE
R5600 SERIES

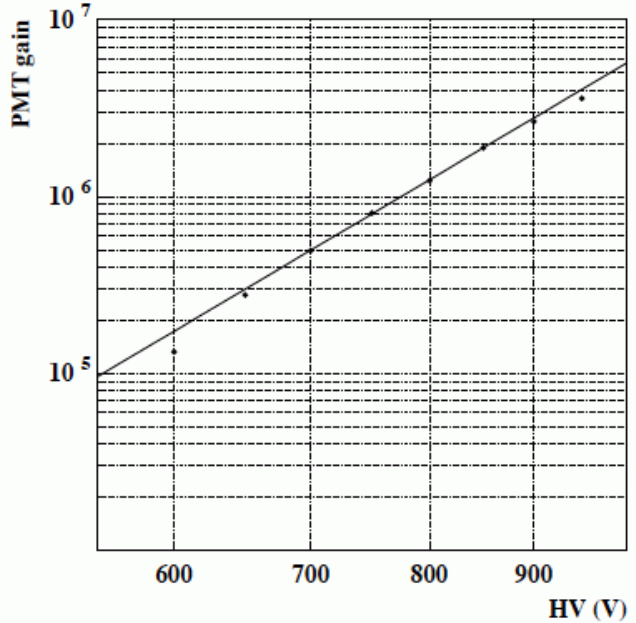
Ultra Compact
TO-8 Metal Can Type 10mm Length, 15mm Diameter, Head-On Type

FEATURES

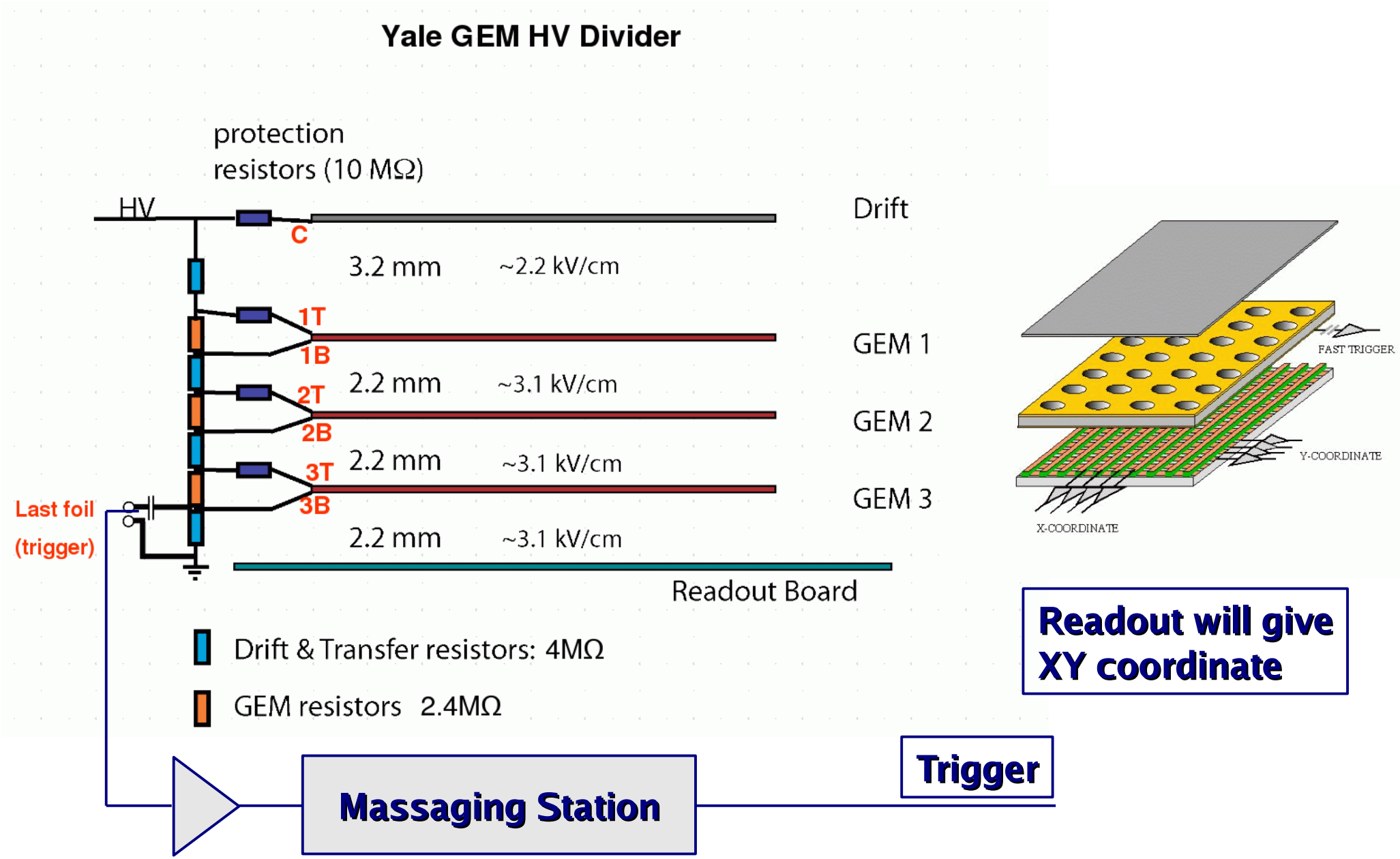
- "METAL PACKAGE PMT" the world smallest photomultiplier tube in a TO-8 metal can (1/7 size volume compared to Hamamatsu R647) New generation of optical detector having the photomultiplier tube performance in a TO-8 size metal can.
- Newly developed "Metal Channel Dynode". Applying a thin layer, "Metal Channel Dynode" developed to make timing characteristics and linearlity better.
- Enable to use for a photon counting detection. (R5600P Type)



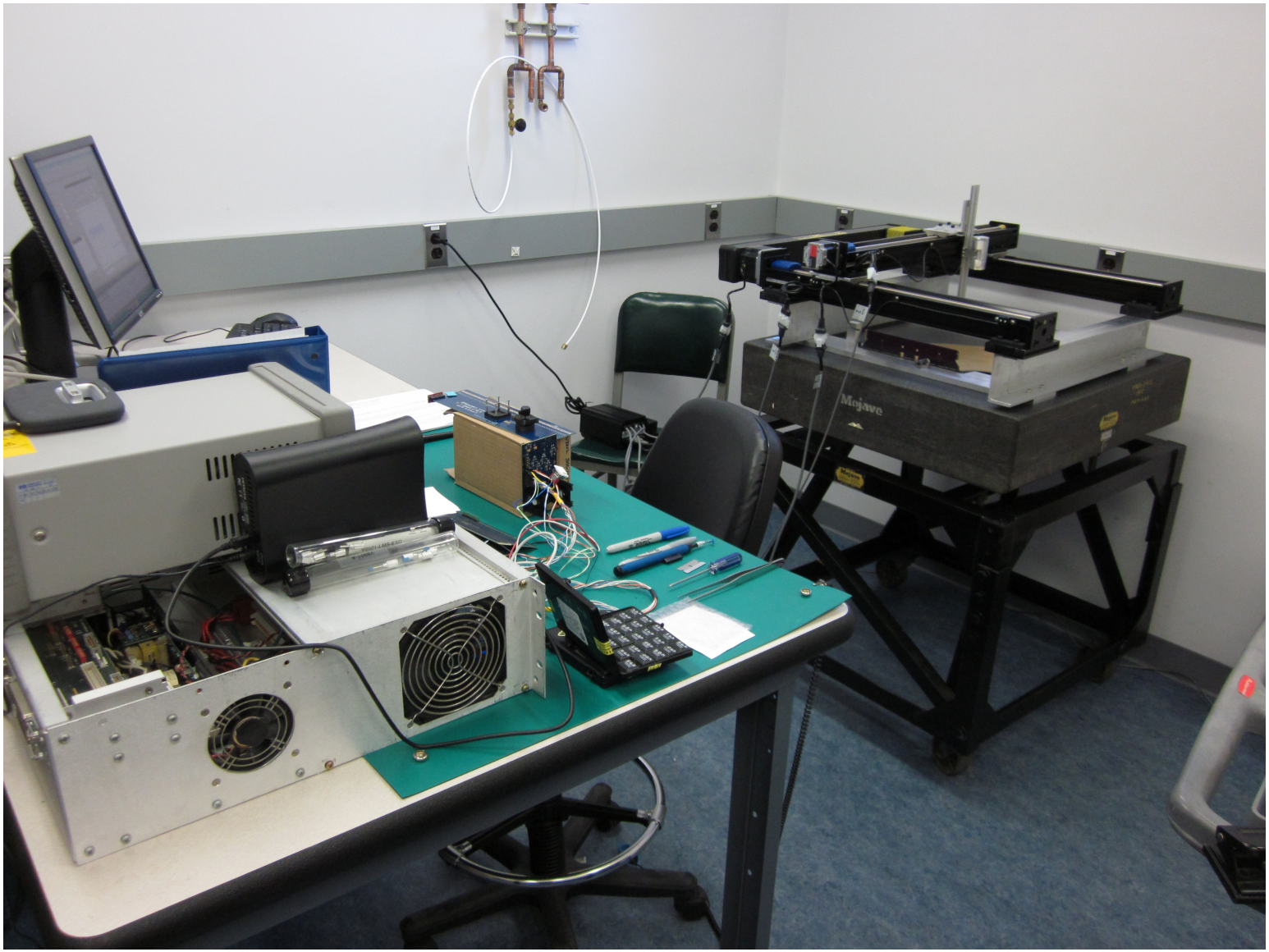
▲Left: R5600, Right: R5600U



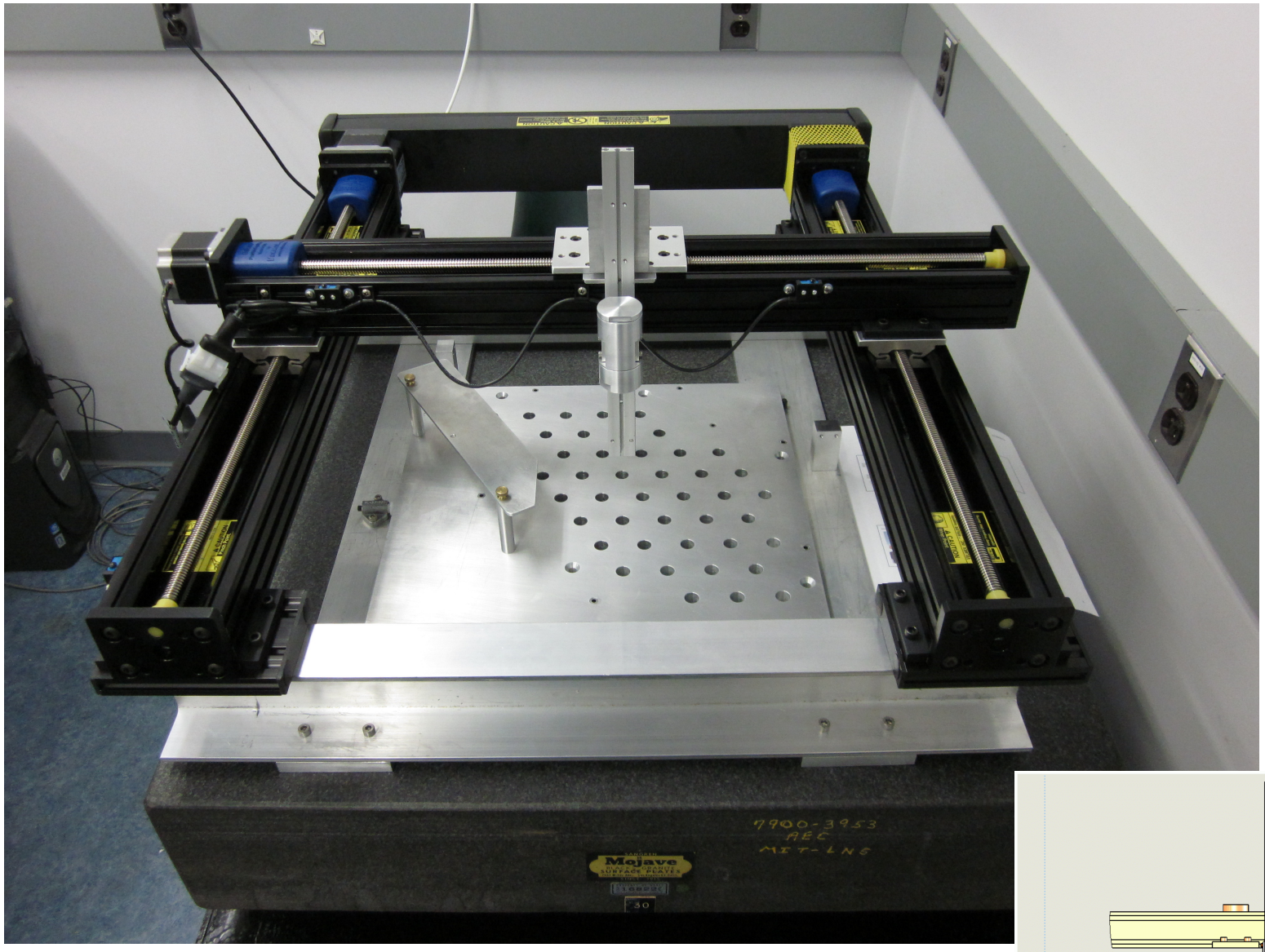
# Internal GEM trigger

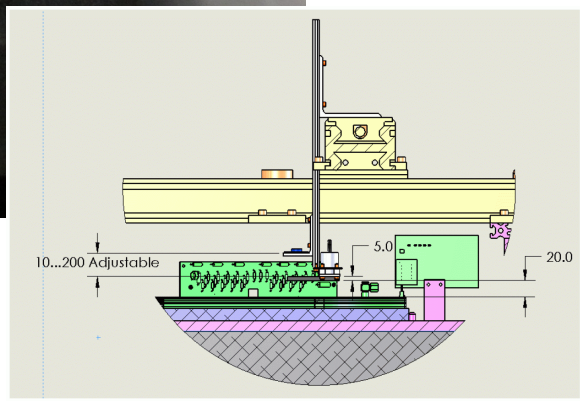


# FGT Quadrant Test Station



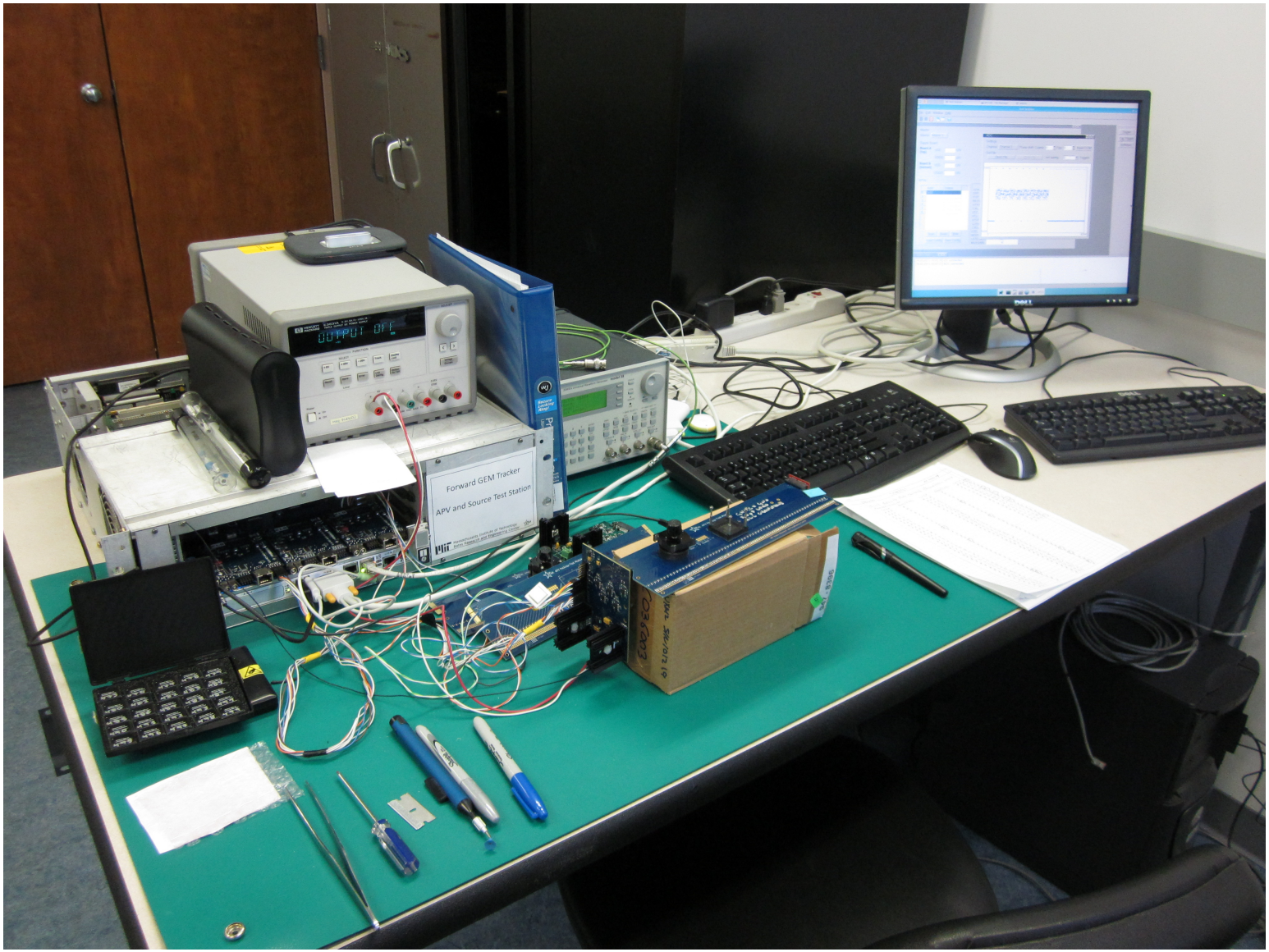
# XY Station



# BIG Paddle

# Readout System



# Next Steps

Mounted large paddle under table

- try with cosmics
- coincidence with GEM trigger
  (no control over track inclination)
- coincidence with small scintillator above quadrant
  (some control over track inclination)

Drilled ½"holes matrix in quadrant support plate

- try with source
- small thinner scintillator above
- coincidence with scintillator paddle under plate
  (good control over track inclination)